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Mortgage Payments and the Cost of Disinflation in the Very Long Run: A Keynesian Model

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Abstract

The effect of front-loading on the mortgage repayment burden of an individual household is well known, but the macroeconomic implications for aggregate consumption are perhaps insufficiently appreciated due to a fallacy of composition. Theories of the sacrifice ratio usually focus on supply-side, Phillips curve processes that cause unemployment in the short run after a disinflation; but disinflation also has a dampening effect on the demand side, and this effect does not fade away. Decades after a step decrease in the inflation rate, households find that discretionary real income is still shrinking relative to what it would have been without the disinflation. According to the classical dichotomy, a nominal variable like inflation “should not” affect real consumption spending in the long run; but the widespread use of naïve heuristics to assess the affordability of home mortgages (and student loans) is an important type of nominal rigidity. Twenty-seven years after the Great Disinflation engineered by Paul Volcker, consumption spending is stagnating. This perspective on the costs of disinflation reverses the standard view where inflation-fighting is seen as a temporary sacrifice with permanent benefits.

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Models of the Phillips curve and the sacrifice ratio generally focus on the effects of disinflation in the supply side of the economy, taking into account producers' expected inflation rate (Phelps, 1977, Lucas, 1975). Those analyses generally conclude that temporary unemployment is a price that must be paid for the enduring benefits that presumably will blossom in an era of low and stable inflation.

Since the Great Disinflation engineered by Paul Volcker we have had twenty-seven years of relatively low and relatively stable inflation, yet the US is mired in a severe downturn that persists due to stagnant consumption spending. Many factors are involved in this recession, of course, but perhaps more attention should be paid to the effect of that disinflation in the 'eighties upon the demand side of the economy today.

Consider in particular the effect of disinflation on homeowners. Home mortgage debt plays an important role in determining a household's consumption spending, especially in the USA where home ownership rates are high.¹ Student loans are increasingly important too, and they are often extended to fifteen or twenty-five years, making them long-term obligations with nominal payments, similar to thirty-year home mortgages.²

The model used here assumes myopic behavior, as do most Keynesian models. In this case the myopia is embedded in common rules of thumb regarding the payment-to-income ratio. Unfortunately, these heuristic devices are widely used by mortgage brokers to assess the supposed affordability of mortgages, and the rules of thumb are in effect a type of nominal rigidity.³ Myopia also plays a role in the consumption function used here: consumption spending is modeled as a function of current (not permanent) income, as in the Keynesian consumption function. A post-Keynesian feature of this model is the use of class-based spending propensities in the tradition of Kaldor (1978) and Kalecki (1978).

2. A model of real income net of mortgage payments

Consider the effect of the disinflation on home "owners" who are in the process of repaying their mortgages. Low inflation diminishes annual cost-of-living adjustments to wages and salaries, leaving each household with a smaller nominal income -- smaller in comparison to its fixed nominal mortgage and student loan payments -- than would have been the case with a higher inflation rate. These smaller nominal cost-of-living increases compound across the decades of repayment, putting a relative squeeze on discretionary real income (i.e., real income net of the mortgage payment).

To be more specific, consider the path of a household's payment-to-income (PTI) ratio during 30 years of mortgage repayment. Typically the PTI ratio starts out at about .36, simply because this is a rule of

¹ These mortgage-related considerations are probably even more important in the US than across the border in Canada. Much of the cross-border difference in home ownership rates is due to the tax deductibility of mortgage interest in the US.

² (???) summarizes the student loan market in the US.

³ Regarding the misleading assessment of affordability that such rules of thumb provide, see for example Haight (2003). Behavioral economists such as (???) emphasize that heuristic devices are often more important than rational models.

thumb that many mortgage brokers use to determine what a household can afford to pay.⁴ Liquidity-constrained households borrow as much as their broker “qualifies” them to borrow, which is whatever amount of mortgage debt brings the monthly payment up to 36% of the first month’s income. To simplify, assume the household will receive nominal pay increases that just keep up with the rising cost of living. As nominal income grows over the years, the fixed nominal mortgage payment absorbs progressively smaller fractions of the growing nominal paycheck. Due to this front loading of the repayment burden, the mortgage payment will “feel” progressively lighter⁵ as the household proceeds through its thirty-year mortgage repayment period. On the other hand, if the inflation rate is stable at a lower level during the repayment period, the cost-of-living increases are smaller, so the PTI ratio does not decline as fast.

As an interesting benchmark case, suppose zero inflation were to be sustained for thirty years. In that case there would be no cost-of-living raises (and therefore, by assumption, no pay increases of any kind for any household), so each household’s PTI ratio would remain at .36 throughout the repayment period, with no relative lightening of the load in the later years of repayment. Another possibility is the scenario where a steady rate of *deflation* is sustained for thirty years; in that case households would suffer from back *loading* of their repayment burden; each year their mortgage payment would eat up a larger fraction of their declining nominal household income.

Here one must beware, however, of a potential fallacy of composition (Samuelson, 19??). It is clear intuitively that a sustained period of high inflation allows each *individual* household to enjoy nominal cost-of-living increases that gradually reduce its proportional outlay for the fixed nominal mortgage payment; hence with steady inflation the discretionary real income and real consumption spending of individual households will increase each year, as discussed above. Yet (once a steady state is achieved) *aggregate* real consumption spending will not increase from year to year: it will be constant.

To clarify this and avoid the fallacy of composition, a model is needed. Consider a country with 30 households (or, say, 30 million households), where one young household takes out a thirty-year mortgage each year. In the steady state that is established after thirty years, there will be one household at each stage along the mortgage repayment path: one household in its first year of repayment, one in its second year ... and one household making its final mortgage payment after thirty years of payments. To simplify, assume that the inflation rate (π) is constant after the step decrease. Assume also that continuous cost-of-living increases in nominal pay are just sufficient to keep up with inflation: at any given time, real household income (\bar{y}) is the same for all households, and nominal income is the same also for all households. Households receive no “real” pay increases over the years.

Let t be the current year and let v be the vintage year of a household’s mortgage; i.e., v is the year that that household bought its house. The first annual mortgage payment is made at the end of that year v , the second annual payment is made at the end of year $v+1$, ... and the last mortgage payment will be made at the end of the year when $t = v+29$.

⁴ Installment debt is often included when calculating the PTI, but to focus on mortgages, other types of debt will not be considered here.

⁵See for example Haight (2003, Jan???)

Due to the mortgage broker's rule of thumb for affordability, each household's fixed nominal mortgage payment ($pymnt_v$) is fixed at 36 percent of what its nominal income was on the date v when that home was purchased:

$$pymnt_v = .36 p_v \bar{y} \quad (1)$$

where p_v was the level of the cost-of-living index in the vintage year v . This cost-of-living index is rising continuously at the inflation rate π :

$$p_t = p_o e^{\pi t} \quad (2)$$

Where p_o is the price level in the base year 0. In any given year t each household has the income \bar{y} in real terms or $p_t \bar{y}$ in nominal terms. Using 2, nominal income can be written as,

$$p_t \bar{y} = p_o e^{\pi t} \bar{y} \quad (3)$$

Combining (1) and (3), the nominal payment (in any year) on a mortgage taken out in year v is

$$pymnt_v = .36 p_o e^{\pi v} \bar{y} \quad (4)$$

The mortgage payment is fixed in nominal terms: the same dollar amount will be due each year for thirty years from $t=v$ to $t= v + 29$. Using (2) and (4), the real value of the mortgage payment made in year t (on a mortgage with vintage v) is given by

$$\frac{pymnt_v}{p_t} = \frac{.36 p_o e^{\pi v} \bar{y}}{p_o e^{\pi t}} = \frac{.36 \bar{y}}{e^{\pi(t-v)}} \quad (5)$$

If inflation is zero then (5) degenerates to the constant $.36 \bar{y}$, indicating that in the absence of inflation the real value of the mortgage payment does not decline: there is no front loading (hence no back unloading) of the repayment burden. For positive values of π , however, inspection of (5) shows that the real value of the annual mortgage payment declines over time, as the quantity $(t-v)$ increases.

Now consider $y_{t,v}^{disc}$, the **discretionary** real income (i.e., real income after making the mortgage payment, student loan payment, etc.) at time t of the household that bought its house at time v :

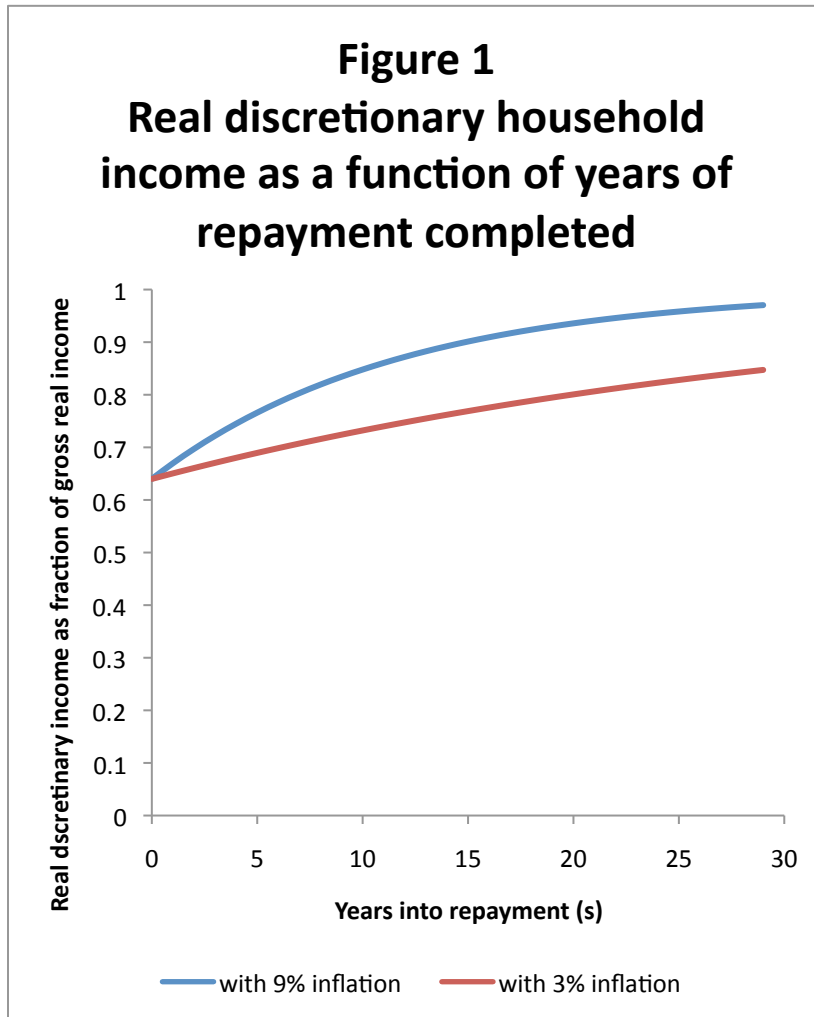
$$y_{t,v}^{disc} \equiv \bar{y} - \frac{pymnt_v}{p_t} \quad (6)$$

Using (5) to rewrite (6),

$$y_{t,v}^{disc} = \bar{y} \left(1 - \frac{.36}{e^{\pi(t-v)}} \right) \quad (7)$$

Here again the zero-inflation case is an instructive benchmark, for when $\pi = 0$, (7) degenerates to $y_{t,v}^{disc} = .64\bar{y}$; real discretionary income is simply 64% of gross real income, which is what is left after paying 36% for the mortgage.

With positive inflation, equation 7 shows that households further into the repayment period (i.e., those with larger values of t-v) have higher real discretionary incomes. Equation 7 is illustrated in Figure 1, where the solid curve shows the path of a household’s real discretionary income over the thirty years of its mortgage payments when inflation is steady at either 9 percent or three percent.



At any given time there will be households at various stages along the path depicted in Figure 1; some households will be just starting repayment, and others will be further along the path. Assume the

country's 30 (million) households are spread out evenly, with one household (or one million households) in the first year of repayment ($t=v$), one in the second year ($t=v+1$)... and one in the thirtieth year of repayment ($t=v+29$).

The **aggregate** (upper-case Y) real discretionary income of the country's thirty mortgage-payers (i.e., home owners) is the sum obtained by evaluating equation (7) at thirty different mortgage-vintage dates v^6 :

$$\begin{aligned}
 Y_{owners}^{disc} &= \bar{y} \left(1 - \frac{.36}{e^{\pi(0)}} \right) + \bar{y} \left(1 - \frac{.36}{e^{\pi(1)}} \right) + \dots + \bar{y} \left(1 - \frac{.36}{e^{\pi(29)}} \right) \\
 &= \bar{y} \left[.64 + \sum_{v=t-29}^{t-1} \left(1 - .36e^{-\pi(t-v)} \right) \right]
 \end{aligned} \tag{8}$$

To avoid the fallacy of composition, note that in (8) there is no time subscript on the aggregate real discretionary income of homeowners (Y_{owners}^{disc}). In the steady state, which is achieved only after inflation has been stable for several decades⁷, the **aggregate** real discretionary income of homeowners is constant from year to year even though the **individual** homeowners enjoy rising discretionary income from year to year. Each year one mortgage is paid off and that house is sold to a new (young) buyer, so there is always one household at each stage of mortgage repayment. Once a steady state has been achieved, the summation in (8) does not change from year to year.

This may seem puzzling. Why is it that the **aggregate** real discretionary income of the group of homeowners does not grow even though the **individual** household's real discretionary income does grow? To explain the puzzle, note that each year, one of the houses in the group of thirty is paid off and sold to a new buyer. Real income is the same for the new occupants as for the previous occupants; but that is not true for real *discretionary* income (i.e., income net of the mortgage payment). The late owners of that house had the benefit of thirty years of inflation-induced back unloading of their mortgage payment, so their final mortgage payment amounted to much less than 36% of their nominal income; their discretionary income during their last year of repayment was much more than $.64\bar{y}$. By contrast, the new occupants of that same house have a discretionary real income that is only $.64\bar{y}$, due to the mortgage broker's 36% rule of thumb. This big year-on-year drop in the discretionary income of the occupants of the house that changes hands cancels out the many small year-on-year gains in discretionary real income that occur in the other 29 houses, leaving aggregate discretionary real income unchanged from year to year in the steady state.

⁶ The first term in brackets is $.64\bar{y}$ because of the broker's rule of thumb that sets the first mortgage payment, when $t-v=0$, at 36 % of income.

⁷ Note that there is also no time subscript on the inflation rate in (8).

A similar phenomenon occurs as cohorts of students (freshmen, sophomores, juniors, and seniors) flow through a college and graduate. Each individual in each class gains knowledge annually, but graduating seniors take a lot of knowledge with them (we hope), so the aggregate or average level of knowledge in the student body does not change from year to year.

3. The long run effect of a disinflation

Now add Volcker to the mix; i.e., suppose there is a sea-change in the inflation regime. Inflation takes a one-time step downward and becomes stable at a new, lower level that is maintained for thirty-plus years. In Figure 1, for example, the old inflation rate is nine percent and the new inflation rate is three percent. (One could quibble about the exact size of the change in inflation, but this is only meant to be only a stylized, qualitative representation of the kind of regime change that occurred when Paul Volcker assumed control of the Fed.) In the decades after that regime change, homeowners do not enjoy as much back-unloading of their debt payments; this leaves their *aggregate* real discretionary income lower in the new steady state. (To continue the college metaphor: if all students suddenly start learning more slowly, then the average or aggregate level of knowledge in the student body declines slightly each year for four years, and then stabilizes at a lower level in the new steady state.)

In the new steady state that is fully established only thirty years later (which will be in the year 2012), each individual household's real discretionary income is on a lower path, as illustrated in Figure 1. This means that the aggregate or average real discretionary income is also lower, as in Figure 1. Inspection of (8) verifies this: when π is lower, each term in the summation is smaller, so the aggregate real discretionary income of the country's homeowners is lower. Thus, the aggregate or average discretionary real income of mortgage payers (i.e., of homeowners) depends on the level of the long-term (and hence fully anticipated) rate of inflation:

$$\frac{\partial Y_{owners}^{disc}}{\partial \pi} > 0 \quad (9)$$

Following post-Keynesians such as Kalecki (19??) and Kaldor (19??), assume that these mortgage payments go to a class of rentiers whose consumption is largely independent of their current income; but consumption spending by people in the home *owning*, mortgage **paying** class *is* sensitive to their current discretionary income. People with mortgages to pay have a higher marginal propensity to consume out of their remaining, discretionary income ($mpc_{mortgage\ payers}$) than the mortgage-payment-**receiving** class of rentiers:

$$mpc_{mortgage\ payers} > mpc_{rentiers} = 0 \quad (10)$$

Given that assumption, real national consumption spending (C) will depend on homeowners' (i.e., mortgage payers') discretionary real income:

$$C = C_o + mpc_{mortgage\ payers} \cdot (Y_{mort}^{disc}) \quad (11)$$

where the (possibly substantial) consumption of the rentier class is included in C_o (autonomous consumption). Combining (9) and (11),

$$\frac{\partial C}{\partial \pi} > 0 \quad (12)$$

That is, in the steady state that is achieved only after the inflation rate has been stable for several decades, aggregate real consumption will be lower if the inflation rate has been lower for those three decades. This is a clear violation of the classical neutrality hypothesis: high (low) inflation leads to high (low) **real** consumption spending, even or *especially* in the *very* long run. This occurs because the 36 percent rule is fixed: it is a type of nominal rigidity.

Conclusion

The effect of front-loading on the mortgage repayment burden of an individual household is well known, but the macroeconomic implication for aggregate consumption is perhaps insufficiently appreciated due to a fallacy of composition. Take the current downturn for example. This is certainly a complex situation with many contributing factors, but one of these is perhaps the 'ghost' of Volcker's Great Disinflation in the early 'eighties. That event would not be a drag on consumption today if homebuyers and their mortgage brokers had anticipated this high repayment burden back then and reduced their .36 rule-of-thumb for mortgage borrowing accordingly.⁸ But the rule of thumb was rigid, so the aggregate real mortgage repayment burden has grown. Indeed, the model suggests that it will continue to grow for several more years, reducing real discretionary income (relative to the no-disinflation baseline scenario) even further before leveling out in the steady state that will finally be achieved some thirty years after the disinflation. With post-Keynesian spending propensities, aggregate real consumption is squeezed for decades due to the lower rate of inflation.

⁸ See for example Haight (2003: The 'Real Feel' of Mortgage Payments).

This demand-side perspective on the cost of disinflation reverses the standard view of inflation-fighting as a heroic temporary sacrifice that leads to permanent benefits.⁹ Aggressive inflation reduction is actually more like throwing out an anchor that drags down consumption spending - and the anchor gets heavier for thirty years.

⁹ Similarly, as I have argued elsewhere (Haight, Winter 2008 JPKE), the Taylor principle for inflation targeting is too hawkish in its war on inflation.